Aga Khan University Examination Board
Notes from E-Marking Center on SSC I Mathematics Examination
May 2012

Introduction

This document has been produced for the teachers and candidates of the SSC Part I (Class IX) course in Mathematics. It contains comments on candidates' responses to the 2012 Secondary School Certificate (SSC-I) Examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

This document should be read along with the AKU-EB Mathematics Examination syllabus based on the National Curriculum (2006).

General Comments

Teachers and candidates should be aware that examiners may ask questions that address the Student Learning Outcomes (SLOs) in a manner that requires candidates to respond by integrating knowledge, understanding and application skills they have developed by studying the course.

Candidates need to be aware that the marks allocated to the questions are related to the answer space provided on the examination paper as a guide to the length of the required response. A longer response will not in itself lead to higher marks. Writing far beyond the indicated space may reduce the time available for answering other questions.

Candidates need to be familiar with the command words in the Student Learning Outcomes which contain terms commonly used in examination questions. However, candidates should also be aware that not all questions will start with or contain one of the command words. Questions such as 'how', 'why' or 'to what extent' may also be used.

Candidates are recommended to read the questions carefully and write all essential steps clearly. Generally, candidates who write all necessary steps, make fewer mistakes. It is also recommended that rough work related to a particular question should be included in the answer booklet because it enables the examiner to assess or to get an insight of the candidates' thinking process.

Detailed Comments

Question 1a

The question offered a choice between part a and b.Most of the candidates attempted part b which shows candidates felt difficulty in complex numbers.

Question 1ai

This was a knowledge based question. Better responses showed that the candidates had clear concept of multiplicative and additive inverse.

Weaker responses showed sign mistakes which led to the incorrect answer.

Question 1aii

The question was related to the addition of complex number and its conjugate.

Better responses showed that the candidates did well to take the conjugate and add with the given complex number in order to get the correct answer.

Weaker responses showed that the candidates were unable to comprehend the meaning of conjugate and as a result could not get the correct answer.

Question 1b

The question was based on the application of the laws of exponent.

Better responses showed that the candidates applied the law of exponent $(a.b)^n = a^n b^n$ and solved it correctly in order to get the correct answer.

Average responses showed that the candidates even though applied the law of exponent correctly but made mistakes in expanding and wrote $\left(16x^8y^4\right)^{1/4} = 16x^2y$ instead of $2x^2y$ so that they were unable to reach the required answer.

Weaker responses showed that the candidates made mistakes in applying the laws of exponent and wrote $\sqrt[4]{16x^8y^4} = \left(16x^8y^4\right)^4$ instead of $\left(16x^8y^4\right)^{1/4}$ which led to the incorrect answer.

Question 2

The question offered a choice between part a and part b.Most of the students attempted part a.

Question 2a

The question was based on the concept of sets.

Better responses showed that the candidates had clear concept of operations of union, intersection, difference and Venn diagram so that they were able to get the correct answer.

Average responses showed that the candidates although did well to find $A \Delta B$ but they were unable to show the elements in the Venn diagram correctly.

Weaker responses showed that the candidates had a lack of concept in difference of sets and as a result they were unable to draw the Venn diagram correctly as well.

Question 2bi

The question was based on the concept of the binary relation $A \times B$.

Better responses showed that the candidates listed the correct elements of $A \times B$, also used the correct parenthesis and commas in order to get $A \times B$.

Average responses showed that the candidates did not use the parenthesis and commas properly so that they were unable to get the correct answer.

Weaker responses showed the candidates made mistakes in finding $A \times B$ and wrote $\{2x, 2y, 4x, 4y, 5x, 5y\}$ instead of $\{(2, x), (2, y), (4, x), (4, y), (5, x), (5, y)\}$ which lead to the incorrect answer.

Question 2bii

The question was based on the concept of the binary relation $A \times B$.

Better responses showed that the candidates did well to write one binary relation and also wrote the correct range of the binary relation.

Average responses showed that the candidates even though wrote the binary relation correctly but they were unable to find the range of the binary relation.

Weaker responses showed that the candidates could not understand the question and wrote any three elements rather than to use the given sets. It was also seen that they made mistakes in writing the range as they wrote domain instead of range.

Question 3

The question was simple and majority of the candidates attempted the question very well in order to convert the logarithmic form into exponential form.

Better responses showed that the candidates had a good concept and did well to solve the question in order to get the correct answer.

Average responses showed that the candidates even though converted the logarithmic form into exponential form correctly i.e. $343 = a^3$ but after that it was seen that some of the candidates made mistakes and wrote $9^3 = a^3$ instead of $7^3 = a^3$ so that they were unable to reach the correct answer.

Weaker responses showed that the candidates made mistakes in converting the logarithmic form into exponential form as they wrote $343 = 3^a$ which was incorrect, thus they could not get the correct answer.

Question 4a

There was a choice available in part a and part b. Most of the candidates opted part a,

Question 4ai

The question was based on the simplification of algebraic expression.

Better responses showed that the candidates substituted the given values correctly and simplified it properly in order to get the correct answer.

Average responses showed that the candidates even though substituted the values correctly but it was seen that they made mistakes in simplifying as they wrote $(-1)^2 = -1$ instead of $(-1)^2 = 1$ and as a result they were unable to reach the required answer.

Weaker responses showed that the candidates directly cancelled the variable of numerator with denominator and then substituted the values which were obviously incorrect and therefore were unable to get the required simplification.

Question 4aii:

The question was based on the application of formulae $(a+b)^2$ and $(a-b)^2$.

Better responses showed that the candidates applied the formula of $(a+b)^2-(a-b)^2=4ab$ directly in order to achieve the correct answer.

Average responses showed that the candidates even though used the formula correctly but made mistakes in simplifying the term as they wrote $x^2+2xy+y^2-x^2-2xy+y^2$ instead of $x^2+2xy+y^2-x^2-2xy+y^2$ as a result they could not reach the correct result.

Weaker responses showed that the candidates made the most common mistake as they wrote $(x+y)^2=x^2+y^2, (x-y)^2=x^2-y^2$, $2xy+2xy=4x^2y$ which lead to the incorrect simplification. This shows that the students did not have the concept of expanding the formula $(a\pm b)^2$, thus they were unable to solve the numerator and denominator accordingly.

Question 4bi

The question was simple and majority of the students had clear concepts of conjugate.

Better responses showed that the candidates did well to take the conjugate, thus they were able to get the correct answer.

Average responses showed that some of the candidates made mistakes in taking the conjugate as they wrote $-\sqrt{2}-\sqrt{3}$ instead of $\sqrt{2}+\sqrt{3}$ and as a result they were unable to get the correct answer.

Weaker responses showed that the candidates did not understand the question and wrote the additive inverse instead of taking conjugate so that they were unable to reach the correct answer.

Question 4bii

The question was based on the application of formula $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$.

Better responses showed that the candidates used the formula $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$ correctly in order to achieve the value of 3*ab*.

Average responses showed that the candidates even though used the formula correctly but made sign mistake in writing the formula as they wrote $(a-b)^3 = a^3 - b^3 + 3ab(a-b)$ instead of $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$ so that they were unable to get the correct answer although solved the question accordingly.

Weaker responses showed that the candidates were unable to use or apply the formula correctly and made mistakes in expanding the formula as they wrote $(a-b)^3 = a^3 - b^3$ which led to the wrong answer.

Question 5

There was a choice available between part a and part b. Majority of the candidates opted part a.

Question 5a

The question was based on the concept of factorization and candidates were expected to factorize the expression of the type $a^2 - b^2 = (a-b)(a+b)$.

Better responses showed that the candidates effectively converted $a^2 + b^2$ into $(a+b)^2$ so that they were able to apply the factorization of the type $a^2 - b^2 = (a-b)(a+b)$ in order to achieve the required answer.

Average responses showed that the candidates were able to do the first step properly i.e. converted $a^2 + b^2$ into $(a+b)^2$ but could not do the further steps accordingly and as a result they were unable to reach the required answer.

Weaker responses showed that the candidates made mistake in the conversion of $(a^2 + b^2)$ into $(a+b)^2$ and applied directly $a^2 - b^2$ which led to the incorrect factorization.

Question 5bi

The question was based on the factorization of type $a^3 + b^3$.

Better responses showed that the candidates did well to take 3 as common from $24t^3 - 3$ and then correctly applied the formula of $(a^3 + b^3)$, thus they were able to achieve the required result.

Average responses showed that the candidates even though took 3 as common from $24t^3 - 3$ but were unable to use the formula of $(a^3 + b^3)$ correctly and directly applied the formula in the expression $(8t^3 - 1)$ as they wrote $((8t)^3 - 1)$ instead of $((2t)^3 - 1)$ which led to the incorrect answer.

Weaker responses showed that the candidates could not comprehend the type of factorization so that they were unable to get the answer correctly.

Question 5bii

The question was based on the factorization of the type $a^2 - b^2 = (a - b)(a + b)$.

Better responses showed that the candidates understood the question very well and applied the formula of $a^2 - b^2$ correctly in order to get the required factorization.

Average responses showed that the candidates made mistakes in applying the formula of $a^2 - b^2$ and directly applied the formula in the expression $(9x^2 - 16)$ as they wrote $(9x)^2 - (4)^2$ instead of $(3x)^2 - (4)^2$ so that they were unable to reach the correct answer.

Weaker responses students could not comprehend the type of factorization so that they were unable to get the answer correctly.

Question 6

The question offered a choice between part a and part b. Majority of the candidates attempted part a.

Question 6a

The question was based on the concept of inversely proportional. Candidates were expected to find the value of t for the given conditions.

Better responses showed that the candidates wrote correctly the relationship between the variables so that they were able to get the required value of t.

Average responses showed that the candidates even though wrote the correct relationship between the variables but could not simplify it correctly. It was also seen that some of the candidates wrote ‘ square of *r*’ instead of ‘ square root of *r*’ and as a result they were unable to reach the required answer.

Weaker responses showed that the candidates were unable to make the relationship between the variables and made mistakes like they wrote directly proportional instead of inversely proportional which led to the incorrect solution.

Question 6b

The question was based on the application of componendo - dividendo theorem.

Better responses showed that the candidates arranged the given condition and applied the required componendo - dividendo theorem correctly in order to prove the required result. It was also seen that few candidates proved the result by K-method.

Average responses showed that the candidates started well by multiplying both the sides by $\frac{3}{7}$ but later on they were unable to use the componendo - dividendo theorem correctly and as a result they could not reach the required proof.

Weaker responses showed that the candidates could not understand the question and as a result they were unable to go further in order to prove the required result.

Question 7i

The question was based on the concept of matrix and candidates were expected to find the matrix *A* whereas its inverse and determinant was given.

Better responses showed that the candidates wrote the adjoint of the given matrix, applied the inverse formula which led to the required matrix.

Average responses showed that the candidates even though used the inverse formula correctly but were unable to find the matrix *A* from the adjoint of *A*.

Weaker responses showed that the candidates made mistakes in finding the adjoint of a matrix so that they could not get the required answer.

Question 7ii

The question was simple and based on the subtraction of the given matrices. Majority of the candidates understood the question well and found the correct matrix.

Question 8

The question was based on the concept of drawing a cumulative frequency polgon.

Better responses showed that the candidates completed the cumulative frequency table, found the upper class boundary and thus they were able to draw the correct cumulative frequency polygon.

Average responses showed that the candidates well completed the cumulative frequency table, found the upper class boundary but made mistakes in drawing a graph as they drew cumulative frequency curve instead of cumulative frequency polygon which was not actually required.

Weaker responses showed that the candidates although calculated the cumulative frequency but they drew the cumulative frequency polygon from mid-point of class interval instead of upper class boundary. It was also seen that few candidates did not calculate the cumulative frequency and they made histogram instead of cumulative frequency polygon which led to the incorrect graph.

Question 9i

The question was based on the concept of theorems related to the sum of interior angle of a triangle $180^{o,}$ and equality of corresponding angle of two congruent triangles.

Better responses showed that the candidates well understood the theorem and found the correct value of angle *A* and angle *D* and also wrote a correct reason in order to justify the answer

Average responses showed that the candidates well understood the theorem and found the correct value of angle *A* and angle *D* but they were unable to write a correct reason.

Weaker responses showed that the candidates either used the equality of corresponding angle or sum of the interior angle of triangle 180^{o}, but could not apply the properties of congruent sides of triangle, thus they were unable to justify their answer accordingly.

Question 9ii

The question was based on the theorem regarding properties of opposite sides of a parallelogram.

Better responses showed that the candidates clearly understood the properties of opposite sides of parallelogram and applied the properties to find the unknown opposite sides of parallelogram $\overline{BC}$. It was also seen that they also applied the property of diagonality of a parallelogram.

Average responses showed that the candidates understood the properties of parallelogram so that they were able to find the required elements but they could not write a correct reason.

Weaker responses showed that candidates were unable to find the value of $m\ \overline{OA}$, which showed the misconception of diagonality of a parallelogram. They also could not justify their answer by using the property.

Question 10

The question offered a choice between part a and part b. It was seen that the candidates equally attempted both the parts.

Question 10ai

The question was based on the theorem that “any point on the right bisector of a line segment in equidistant from its end.”

Better responses showed that the candidates well understood the theorem and wrote the correct answer or reasons to justify the answer.

Average responses showed that the candidates understood the theorem well to find the value of $m\overline{BC}$ but it was seen that some of the candidates could not write a reason in order to justify the answer.

Weaker responses showed that the candidates could not understand the theorem so that they were unable to get the answer or reasons to justify the answer.

Question 10aii

The question was based on the theorem “smallest side of a triangle has an angle of smaller measure opposite to it”.

Better responses showed that the candidates well understood the theorem and wrote the correct answer or reasons to justify the answer.

Average responses showed that the candidates were able to find the smallest side but they did not write a reason to justify the answer.

Weaker responses showed that fewer candidates made mistake in finding the smallest side of the triangle and as a result they could not write a reason.

Question 10bi

The question was based on the concept of identifying the sides of a triangle.

Better responses showed that the candidates had a concept of indentifying the sides of a triangle and thus were able to write a correct reason.

Average responses showed that the candidates well answered the question but could not clearly write a reason to justify the answer.

Weaker responses showed that the candidates had no any idea how to give the answer and write a reason.

Question 10bii

The question was based on the concept of similar triangle.

Better responses showed that the candidates used well the condition of similar triangle and thus were able to find $m\ \overline{DE}$.

Average responses showed that the candidates wrote correctly the condition of similar triangle but could not substitute the values correctly in order to get the required answer..

Weaker responses showed that the candidates were unable to write the condition of similar triangle and thus they could not find $m\ \overline{DE}$ accordingly.

Question 11

The question was based on the concept of constructing a triangle. Candidates were expected to construct a triangle with the given measurements and also to draw the perpendicular bisectors of a triangle.

Better responses showed that the candidates effectively constructed the triangle and draw the perpendicular bisector of a triangle as well.

Average responses showed that the candidates even though constructed the triangle but it was seen that some of the candidates made mistakes in drawing a perpendicular bisector as they drew angle bisectors instead of perpendicular bisectors.

Weaker responses showed that the candidates were unable to construct the triangle with the help of the given measurements, thus they could not go further in order to get the required result.